

## WHAT IS CLAIMED IS

1. In a passive optical network (PON) a method for transmitting packets by an optical network unit (ONU) comprising the steps of:
  - a receiving a grant having a grant length from an optical line terminal (OLT) of the PON; and
  - b. based on said grant, calculating an ONU packet egress order that eliminates packet fragmentation.
2. The method of claim 1, wherein said step of calculating is preceded by a step of handling out of band information, and includes handling a sub-queue of a given priority.
3. The method of claim 2, wherein said handling includes checking said sub-queue for ungranted packets, and wherein said step of calculating includes performing a three stage test on each of said ungranted packets, each of said stage tests involving a stage variable.
4. The method of claim 3, wherein said stage variable is selected from the group consisting of reported bytes below threshold, reported total bytes, and total bytes, and wherein said performing of a stage test involving a stage variable includes comparing a value of said stage variable to zero.
5. The method of claim 4, wherein said ungranted packet is marked as granted, if the result of said comparison is that said value of said stage variable is greater than zero.
6. The method of claim 1, wherein said grant is a flexible grant set by said OLT based on information received from the ONU.
7. The method of claim 7, wherein said information includes a combination of values of bytes below threshold and total bytes.
8. The method of claim 7, wherein said threshold is adaptive.

9. The method of claim 7, wherein said values of bytes below threshold and total bytes are accumulated from highest to lowest priority.
10. In a passive optical network (PON), a method for eliminating packet fragmentation comprising the steps of:
- a. providing an optical line terminal (OLT) connected to a plurality of optical network units (ONUs), each of said ONUs transmitting packets arranged in sub-queues having a total byte length, said packets transmitted in response to a grant received from said OLT, said grant having a grant length; and
  - b. matching said total byte length with said grant length, whereby the fragmentation loss is eliminated.
11. The method of claim 10, wherein said step of matching includes hiding, by each said ONU, an update in a queue status from said OLT.
12. The method of claim 11, wherein said hiding includes freezing a transmission order of queues.
13. The method of claim 11, wherein said step of matching further includes checking, from highest to lowest priority each of said sub-queues, identifying in each said sub-queue ungranted packets with respective ungranted packet lengths, and marking each said ungranted packet as about to be transmitted.
14. The method of claim 13, wherein said marking includes comparing to zero a stage variable selected from the group of reported bytes below threshold, reported total bytes, and total bytes, and marking said ungranted packet as granted if said stage variable is greater than zero.
15. The method of claim 14, wherein said marking is followed by removing said ungranted and marked packet length from reported and current variables.

16. A method for setting a threshold for dynamic bandwidth allocation in a passive optical network that includes an optical line terminal (OLT) and a plurality of optical network units (ONUs), the method comprising the steps of:

- a. providing a weighted fair queueing configuration to the OLT; and
- b. providing a threshold used in combination with said weighted fair queueing configuration by the OLT while granting a grant with a desired grant length to an ONU.

17. The method of claim 16, wherein said step of providing a threshold includes calculating, by the OLT, a threshold for each sub-queue, and transmitting said threshold to said ONU.

18. The method of claim 17, wherein said calculating said threshold includes multiplying said desired grant length by a class ratio of said sub-queue and by a calibration factor.

19. The method of claim 18, wherein said threshold is an adaptive threshold, and wherein said transmitting is followed by counting, by the OLT, of bytes transmitted from each said sub-queue, adding said counted bytes to a total bytes counted variable, checking a difference between measure and expected class ratios, and based on said checking, adjusting said threshold.

20. A method for setting a threshold in a passive optical network that includes an optical line terminal (OLT) and a plurality of optical network units (ONUs), the OLT granting grants to the ONUs, the ONUs transmitting packages arranged in sub-queues in response to the grants, the method comprising the steps of:

- a. performing a comparison between parameters reported by an ONU and a desired grant length; and
- b. adjusting a threshold based on the results of said comparison, thereby providing a target bandwidth adaptation mechanism in which the threshold value of all sub-queues is identical.

21. The method of claim 20, wherein said parameters include a reported total bytes parameter, and wherein said step of performing a comparison includes summing said values of reported total bytes for all sub-queues to obtain a total bytes sum, and, if said total bytes sum is larger than said desired grant length, summing values of reported bytes below threshold of each sub-queue to obtain a bytes below threshold sum.

22. The method of claim 21, wherein said step of performing a comparison further includes comparing said bytes below threshold sum to said desired grant length, and wherein said step of adjusting said threshold includes decreasing said threshold if said bytes below threshold sum is larger than said desired grant length.

23. The method of claim 21, wherein said summing of values of reported bytes below threshold of each sub-queue to obtain a bytes below threshold sum includes summing said values from a highest priority to a configurable priority to obtain a high-priority sub-queues sum

24. The method of claim 23, wherein said step of performing a comparison further includes comparing said bytes below threshold high-priority sub-queues sum to said desired grant length, and wherein said step of adjusting said threshold includes increasing said threshold if said bytes below threshold high-priority sub-queues sum is smaller than said desired grant length.

25. A method for setting a threshold in a passive optical network that includes an optical line terminal (OLT) and a plurality of optical network units (ONUs), the OLT granting periodically a grant having a grant length to each ONU, each ONU transmitting packages arranged in sub-queues in response to a grant, the method comprising the steps of:

- a. providing a plurality of priorities each associated with a sub-queue of packages, each said priority having a unique priority threshold; and
- b. adjusting each said priority threshold such that a sum of all said adjusted priority thresholds has a fixed value.

26. The method of claim 25, wherein said fixed value is larger than the grant length.
27. The method of claim 25, wherein said step of adjusting includes comparing a value of bytes below threshold of each said sub-queue with said unique priority threshold.
28. The method of claim 27, wherein said comparison finds that for a particular said sub-queue said value of bytes below threshold is smaller than said threshold, and wherein said step of adjusting further includes decreasing the threshold of said particular sub-queue and increasing the threshold of each other said sub-queue to obtain said fixed sum value.
29. The method of claim 27, wherein said comparison finds that for a particular said sub-queue said value of bytes below threshold is greater than said threshold, and wherein said step of adjusting further includes increasing the threshold of said particular sub-queue and decreasing the threshold of each other said sub-queue to obtain said fixed sum value.